

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

Please cancel Claims 1-27.

1 28. (Original) A method of providing a multi-layer semiconductor structure, the  
2 method comprising:

3 providing a first semiconductor structure having first and second opposing  
4 surfaces; and

5 disposing a laminate layer over a first one of the first and second opposing  
6 surfaces of the first semiconductor structure to provide a first semiconductor structure  
7 having a laminate layer disposed thereon.

1 29. (Original) The method of claim 28 further comprising:

2 disposing a handle member over the laminate layer.

1 30. (Original) The method of claim 29 further comprising:

2 a substrate on a second one of the first and second opposing surfaces of the first  
3 semiconductor structure.

1 31. (Original) The method of claim 30 further comprising:

2 removing at least a portion of the substrate from the second one of the first and  
3 second opposing surfaces of the first semiconductor structure to provide a  
4 semiconductor-handle complex.

1 32. (Original) The method of claim 31 further comprising:

2 providing a second semiconductor structure); and

3 aligning a first surface of the semiconductor-handle complex with a first surface  
4 of the second semiconductor structure.

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

- 1 33. (Original) The method of claim 32 further comprising:
  - 2 bonding the first surface of the second semiconductor structure to the first surface
  - 3 of the semiconductor -handle complex.
  
- 1 34. (Original) The method of claim 33 further comprising:
  - 2 removing the handle member and the laminate layer.
  
- 1 35. (Original) The method of claim 28 wherein providing a first semiconductor structure having first and second opposing surfaces comprises:
  - 3 a substrate having first and second opposing surfaces; and
  - 4 a first semiconductor structure over a first one of the first and second surfaces of
  - 5 the substrate.
  
- 1 36. (Original) The method of claim 28 wherein providing a first semiconductor structure having first and second opposing surfaces comprises:
  - 3 providing a semiconductor structure comprised of a plurality of thin film
  - 4 semiconductor layers.
  
- 1 37. (Original) The method of claim 29 wherein disposing a handle member over the laminate layer comprises:
  - 3 providing a handle substrate;
  - 4 disposing a film layer over at least one surface of the handle substrate.
  
- 1 38. (Original) The method of claim 37 wherein the film layer is provided from one of: silicon nitride; and silicon dioxide.
  
- 1 39. (Original) The method of claim 38 further comprising disposing a laminate over a surface of the handle member.
  
- 1 40. (Original) The method of claim 29 wherein disposing a handle member over the laminate layer comprises disposing a handle member over the laminate layer such

Appl. No. 10/749,103

Docket No. MITT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

3 that a surface of the laminate adheres to a surface of the handle member.

1 41. (Original) The method of claim 29 wherein disposing the laminate layer over  
2 a first one of the first and second opposing surfaces of the first semiconductor structure to  
3 provide a semiconductor structure having a laminate layer disposed thereon comprises  
4 providing a laminate layer comprised of a plurality of layers.

1 42. (Original) The method of claim 41 wherein providing a laminate layer  
2 comprised of a plurality of layers comprises:

3 providing a first layer corresponding to a release layer;  
4 providing a second layer corresponding to a metal adhesion / diffusion barrier  
5 layer; and  
6 providing a third layer corresponding to a fusion layer.

1 43. (Original) The method of claim 42 wherein the release layer comprises at  
2 least one of zirconium and aluminum.

1 44. (Original) The method of claim 42 wherein the metal adhesion / diffusion  
2 barrier layer comprises tantalum.

1 45. (Original) The method of claim 42 wherein the fusion layer comprises at least  
2 one of copper; a polymer; and an inorganic dielectric.

1 46. (Original) The method of claim 41 wherein providing a laminate layer  
2 comprised of a plurality of layers comprises:  
3 providing a first layer corresponding to a metal adhesion / diffusion barrier layer;  
4 providing a second layer corresponding to a release layer; and  
5 providing a third layer corresponding to a fusion layer.

1 47. (Original) The method of claim 46 wherein the release layer comprises at  
2 least one of zirconium and aluminum.

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

1 48. (Original) The method of claim 46 wherein the metal adhesion / diffusion  
2 barrier layer comprises tantalum.

1 49. (Original) The method of claim 46 wherein the fusion layer comprises at least  
2 one of copper; a polymer; and an inorganic dielectric.

1 50. (Original) The method of claim 41 wherein providing a laminate layer  
2 comprised of a plurality of layers comprises providing a laminate layer comprised of two  
3 layers with a first one of the layers corresponding to a release layer and second one of the  
4 layers corresponding to one of:

5 a polymer having an adhesive characteristic which allows the laminate layer to  
6 adhere to the surface of the thin film semiconductor structure;  
7 an inorganic material; and  
8 copper.

1 51. (Original) The method of claim 28 wherein disposing a laminate layer  
2 comprises providing a laminate layer comprised of a single layer having an adhesive  
3 characteristic which allows the laminate layer to adhere to the surface of the  
4 semiconductor structure and having a characteristic such that the layer releases from the  
5 surface of the semiconductor structure in response to being exposed to a release agent.

1 52. (Original) The method of claim 29, wherein disposing a laminate layer  
2 comprises providing a laminate layer comprised of a single layer having an adhesive  
3 characteristic which allows the laminate layer to adhere to a surface of the handle  
4 member and having a characteristic such that the layer releases from the surface of the  
5 semiconductor structure in response to being exposed to a release agent.

1 53. (Original) The method of claim 31, wherein removing the substrate from the  
2 second one of the first and second opposing surfaces of the semiconductor structure to  
3 provide a semiconductor-handle complex comprises removing a portion of the second

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

4 surface of the semiconductor-handle complex using at least one of: a mechanical  
5 grindback, an aqueous chemical etch; a vapor chemical etch; and a plasma etch.

1 54. (Original) The method of claim 33, wherein bonding the first surface of the  
2 second semiconductor structure to the first surface of the semiconductor-handle complex  
3 comprises providing bonding pads on at least one of the first surface of the second  
4 semiconductor structure; and the first surface of the semiconductor-handle complex.

1 55. (Original) The method of claim 54, wherein the bonding pads are provided  
2 from at least one of: copper; a polymer, and an inorganic dielectric.

1 56. (Original) The method of claim 34 wherein removing the handle member and  
2 the laminate layer comprises using at least one of:

3 an aqueous-activated method;  
4 a vapor-activated method;  
5 a light-activated method;  
6 a temperature-activated method;  
7 an ion bombardment-activated method;  
8 an electrically-assisted method; and  
9 a mechanical method.

1 57. (Original) The method of claim 28 wherein the semiconductor structure  
2 corresponds to a die-to-die semiconductor structure.

1 58. (Original) The method of claim 28 wherein the semiconductor structure  
2 corresponds to a die-to-wafer semiconductor structure.

1 59. (Original) The method of claim 28 wherein the semiconductor structure  
2 corresponds to a wafer -to-wafer semiconductor structure.

1 60. (Original) The method of claim 28 wherein:  
2 providing a first semiconductor structure having first and second opposing

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

3 surfaces comprises providing a first semiconductor structure having a face surface and a  
4 backside surface; and

5 disposing a laminate layer comprises disposing a laminate layer over the face of  
6 the first semiconductor structure to provide a semiconductor structure having a laminate  
7 layer disposed thereon.

1 61. (Original) The method of claim 32 wherein:

2 providing a second semiconductor structure comprises providing a second thin  
3 film semiconductor structure; and

4 aligning a first surface of the semiconductor -handle complex with a first surface of the  
5 second semiconductor structure comprises aligning the backside of the semiconductor-handle  
6 complex with a face of the second thin film semiconductor structure.

7

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1 62. (Original) The method of claim 1 wherein:

2 the first semiconductor structure corresponds to an original semiconductor  
3 substrate;

4 the first semiconductor-handle complex having a substrate portion corresponds to  
5 an original-handle complex having a substrate portion;

6 the handle-semiconductor complex corresponds to a handle-thin film complex;

7 the second semiconductor structure corresponds to a second substrate.

1 63. (Original) The method of claim 62 wherein:

2 the original semiconductor substrate corresponds to a first thin-film substrate

3 the second substrate corresponds to a second thin-film substrate

1 64. (New) A multi-layer semiconductor structure comprising:

2 a first semiconductor structure having first and second opposing surfaces; and

3 a laminate layer over one of the first and second opposing surfaces of the first  
4 semiconductor structure to provide a first semiconductor structure having a laminate layer  
5 disposed thereon.

Appl. No. 10/749,103

Docket No. MTT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

1 65. (New) The structure of claim 64 further comprising a handle member disposed over  
2 the laminate layer.

1 66. (New) The structure of claim 64 further comprising a substrate disposed on a second  
2 one of the first and second opposing surfaces of the first semiconductor structure.

1 67. (New) The structure of claim 64 wherein the first semiconductor structure comprises a  
2 plurality of thin film semiconductor layers.

1 68. (New) The structure of claim 65 further comprising a film layer disposed over at least  
2 one surface of the handle member.

1 69. (New) The structure of claim 68 wherein the film layer is provided from one of:  
2 silicon nitride; and silicon dioxide.

1 70. (New) The structure of claim 68 further comprising a laminate disposed over a  
2 surface of the handle member.

1 71. (New) The structure of claim 64 wherein said laminate layer comprises:  
2 a first layer corresponding to a release layer;  
3 a second layer corresponding to a metal adhesion / diffusion barrier layer; and  
4 a third layer corresponding to a fusion layer.

1 72. (New) The structure of claim 71 wherein the release layer comprises at least one of  
2 zirconium and aluminum.

1 73. (New) The structure of claim 72 wherein the metal adhesion / diffusion barrier layer  
2 comprises tantalum.

1 74. (New) The structure of claim 73 wherein the fusion layer comprises at least one of  
2 copper; a polymer; and an inorganic dielectric.

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

- 1 75. (New) The structure of claim 64 wherein said laminate layer comprises:
  - 2 a first layer corresponding to a metal adhesion / diffusion barrier layer;
  - 3 a second layer corresponding to a release layer; and
  - 4 a third layer corresponding to a fusion layer.
  
- 1 76. (New) The structure of claim 75 wherein the release layer comprises at least one of
  - 2 zirconium and aluminum.
  
- 1 77. (New) The structure of claim 76 wherein the metal adhesion / diffusion barrier layer
  - 2 comprises tantalum.
  
- 1 78. (New) The structure of claim 77 wherein the fusion layer comprises at least one of
  - 2 copper; a polymer; and an inorganic dielectric.
  
- 1 79. (New) The structure of claim 64 wherein said laminate layer comprises two layers
  - 2 with a first one of the layers corresponding to a release layer and second one of the layers
  - 3 corresponding to one of:
    - 4 a polymer having an adhesive characteristic which allows the laminate layer to adhere
    - 5 to the surface of the thin film semiconductor structure;
    - 6 an inorganic material; and
    - 7 copper.
  
- 1 80. (New) The structure of claim 64 wherein said laminate layer comprises a single layer
  - 2 having an adhesive characteristic which allows the laminate layer to adhere to the surface of
  - 3 the semiconductor structure and having a characteristic such that the layer releases from the
  - 4 surface of the semiconductor structure in response to being exposed to a release agent.
  
- 1 81. (New) The structure of claim 64 wherein the semiconductor structure corresponds to a
  - 2 die-to-die semiconductor structure.
  
- 1 82. (New) The structure of claim 64 wherein the semiconductor structure corresponds to a
  - 2 die-to-wafer semiconductor structure.

Appl. No. 10/749,103

Docket No. MIT-136BUS

Reply to Notice of Non-Compliant Amendment dated August 3, 2005

1 83. (New) The structure of claim 64 wherein the semiconductor structure corresponds to a  
2 wafer-to-wafer semiconductor structure.

1 84. (New) The structure of claim 64 wherein a portion of the substrate from the second  
2 one of the first and second opposing surfaces of the first semiconductor structure and the  
3 handle member provide a semiconductor-handle complex and wherein the structure further  
4 comprises:

5 a second semiconductor structure corresponding to a second thin film semiconductor  
6 structure disposed over a first surface of the semiconductor-handle complex with a first  
7 surface of the second thin film semiconductor structure aligned with a backside of the  
8 semiconductor-handle complex.

1 85. (New) The structure of claim 84 wherein:

2 the first semiconductor structure corresponds to an original semiconductor substrate;  
3 the first semiconductor-handle complex having a substrate portion corresponds to an  
4 original-handle complex having a substrate portion;  
5 the handle-semiconductor complex corresponds to a handle-thin film complex; and  
6 the second semiconductor structure corresponds to a second substrate.

1 86. (New) The structure of claim 85 wherein the original semiconductor substrate  
2 corresponds to a first thin-film substrate.